Organisational Culture Matters for System Integration in Health Care

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Abstract

This paper illustrates the importance of organisational culture for Clinical Information Systems (CIS) integration. The study is based on data collected in intensive care units in the UK and Denmark. Data were collected using qualitative methods, i.e., observations, interviews and shadowing of health care providers, together with a questionnaire at each site. The data are analysed to extract salient variables for CIS integration, and it is shown that these variables can be separated into two categories that describe the 'Actual Usefulness' of the system and the 'Organisational Culture'. This model is then extended to show that CIS integration directly affects the work processes of the organisation, forming an iterative process of change as a CIS is introduced and integrated.

Introduction

The past two decades have given rise to increasingly more sophisticated and smarter methods for designing, developing and implementing clinical information systems, yet few health care organisations are able to exploit this fully[1]. There is much evidence to suggest that Clinical Information Systems (CIS), when implemented in a clinical setting may be greeted with skepticism and uncertainty as to their capabilities and to their integration into the work place[2,3,4]. Many systems remain unused, and those few that are diffused into their environment are usually not fully exploited.

Several studies have focused upon randomised controlled trials for evaluation purposes, but it has been stated that this is not the best method of understanding the intricacies of organisational issues, especially for gauging user perceptions of CIS implementation[5,6,7]. It has also been found that people issues are a neglected aspect of electronic patient record (EPR)* implementation[8].

An extensive literature review of over 1832 papers indexed in MEDLINE has shown that there is insufficient research into the sociological, organisational and cognitive effects of EPR[9]. Only a few studies have covered these issues[5,6,10,11,12,13], and there is insufficient investigation of organisational factors such as organisational structure, culture, learning, behaviour and power and politics. This has given rise to a mass of studies claiming to research organisational issues; upon closer examination it appears that organisational issues comprise only a fraction of their work. This paper investigates one of these issues, organisational culture, which has been given little consideration in Health Informatics, although it is well established in industry [14]. Organisational culture is an area of great consequence and can inform the effective integration of CIS into the clinical environment.

There are myriad definitions of organisational culture [14], but it is generally taken to encompass a particular set of values, beliefs, expectations, customs and systems that are common to an organisation. Detailed discussion can be found in texts by Burnes [14], Schwartz and Davis [15] and Kotter and Hesketh[16]. However, the essence of organisational culture is illustrated very simply as *"the way that we do things around here"*[16]. Taking this statement as a premise, changing from a paper-based CIS to an electronic system would certainly imply a change in organisational culture.

This paper demonstrates the importance of organisational culture for CIS integration in an intensive care unit (ICU). Data were collected in three ICUs, one in the UK and two in Denmark, and were used to produce a model of CIS integration.

Acute care is complex and demanding both in terms of the work processes and health care provider's clinical information needs [17], it is therefore important to investigate this environment from a cultural perspective to facilitate CIS integration. In an area such as acute care, wherein the care of the patient is paramount and immediate, one cannot afford to get it wrong. Failed systems may also result in a negative impact on health care professionals' attitudes towards future implementations.

Research Methods

Ethics

Local research ethics committees approved research for each site. Participants were promised

* In this paper a CIS is any system that manages patient information, for example an EPR, EHR or Patient Data Management system. This includes paper systems and hybrids that are a mixture of paper and electronic records.

confidentiality and anonymity where possible and were given a research protocol. To preserve anonymity the hospitals will be referred to as Sites A, B and C; names of CIS are not stated, nor electronic health record (EHR) modules described.

Describing the Settings

This study is based in three ICUs. Sites A and B have introduced a computer CIS, both using a Top-Down[†] perspective, while Site C still uses paper to hold patient information. Sites B and C are both situated in the same county of Denmark and use the same automated laboratory results reporting tool, which has been deployed for over a decade. The study focus lies with ICU nurses and doctors as they are the primary and most frequent users of the systems.

Site A

This is a seven bed ICU in the northwest of England, employing 90 shift nurses and 58 duty doctors. Their system is a complete patient information system, replacing all paper records. The system is tailored for nurses and doctors, so that nurses have a separate area in the system for patient care plans and doctors have an area for their notes. Among other things, observational data is downloaded directly from monitors, drugs calculations are performed automatically, and full patient administration is offered by the system.

The system was first implemented in August 1998, with full changeover from paper to computer eight months later in April 1999. The aim of implementation was to eliminate paper in the ICU and to aid report writing and statistical analysis of data, as well as to carry out calculations that were described as 'vexing'. As an added benefit of the system, clinical governance, was said to be "much easier to observe than previously".

Site B

Site B is one of five university hospitals in a county of Denmark. The ICU offers twenty beds and is divided into four specialist areas: heart, respiratory, brain and child-specific intensive care. All have the same staffing, technologies and physical layout. Over 220 shift nurses and approximately 100 duty doctors are employed here. The CIS is a patient data management system comprising four areas: an automated charting facility to record observations at point of care; automated clinical documentation such as treatments; care protocols and patient progress; remote documentation of findings for observational data, and a reporting tool that enables analysis for quality assurance, cost containment, process monitoring, scoring, and outcomes management.

The system was introduced in September 2002 in parallel with the paper system, which was phased out in December 2002. As well as replacing the nurses' 24 hour paper observation charts, the CIS facilitates management to make better use of the data for planning and financing of resources.

Site C

Another of the Danish university hospitals, the third ICU has eight beds, of which six were in use during this study. The ICU employs approximately 40 shift nurses and 30 doctors. This site uses a paper-based CIS for all aspects of patient information. However, there are plans to introduce an EHR system in all hospitals in this county by Summer 2003. This ICU is heavily involved in developing one of the modules for this EHR.

Data Collection Methods

A qualitative approach was employed for data collection as it was deemed the most appropriate for researching people and their behaviours, attitudes, and cultures in their natural environment[18]. This enabled the researcher to attain a rich understanding of not only the participants, but also the environment in which they worked, thus ensuring that the results were not out of context and had real world significance.

The data collection methods used are given below:

- direct observation
- semi-structured interviews
- shadowing of health care providers
- a mixture of structured and unstructured questions via questionnaires[‡].

Data were collected over a period of four weeks in each setting. It was decided that the morning shift (0730 – 1530 hours) would be the most appropriate time period, as during this time it is possible to observe great many health care providers interacting with each other and the CIS; other shifts were not observed for pragmatic reasons. However clinicians were asked about their routine on all shifts during the interviews. The qualitative results were verified using a questionnaire that was distributed to a random sample of 75 staff in sites A and B, and 70 in site C; these questionnaires were piloted with nurses and doctors at each hospital, before being distributed fully.

Participants

The directors of each department were approached initially. Health care professionals were informed

[†] Here 'Top-Down' refers to all aspects of system procurement and implementation as being led by the managers of the unit's rather than being led by staff lower down the hierarchy.

[‡] Due to space restrictions, it is not possible to describe the questionnaire results in more detail, here. However the questionnaire results will be addressed in future papers.

about the research during their morning meetings, and also via email, to legitimate the researcher's presence. Where staff did not receive this message the researcher explained to them the reasons for 'being there' if approached. Two nurses and two ICU doctors were shadowed during their working day in each hospital. This was carried out towards the end of the data collection period, after the observations, in order to verify findings. Interviews were conducted with senior management, doctors and nurses, the key users of the systems.

Systematic Recording of Data

Observation notes were categorized into three types [19]: *Observational notes*: recording exactly what was observed, with no 'noise' from the researcher. *Methodological notes*: pragmatics of the research. *Theoretical notes*: where the researcher noted any patterns or theories emerging.

Findings and Discussion

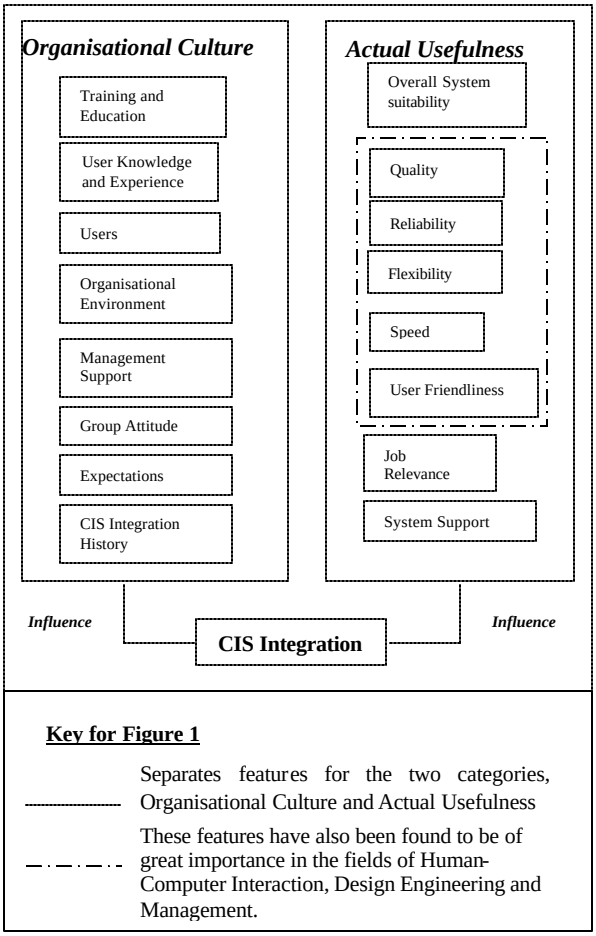
Results were formulated by application of grounded theory, a common and well-documented methodology in qualitative research, where theory emerges from the data collected[19,20]. As well as methodological triangulation (i.e., a variety of data collection methods) and source triangulation (i.e., a variety of informants), findings were further grounded, in that the three ICUs are of different sizes and were also at different stages of CIS implementation. Site A has a fully implemented CIS, site B a newly implemented CIS, and site C is in preparation for a CIS. The vast amounts of qualitative data produced were analysed and then verified using the questionnaires. Questionnaire response rates were 42% at site A, 9% at site B and 11% at site C. While the last two are relatively low[§], the combined response rate of 21% is well within acceptable levels [18]. Use of a combined response rate is justified because findings were consistent irrespective of size, location, and phase of implementation. Data analysis enabled the identification of 16 salient features that are important for CIS integration; these features are detailed in the next section.

The Technology Acceptance Models TAM and TAM2 examine the adoption of technological systems [22,23]; the model is based on data collected from MBA students and later in industry. There are limited studies of the application of TAM in health care[24], however, the TAM models do not consider organisational issues, which this paper argues are an important part of CIS integration; this may be part of the reason why TAM is reported to consistently explain only 40% of system use[25]. For this reason, this paper introduces alternative models grounded in the data collected and developed during this study.

Model One

Sixteen salient features were extracted during this analysis; they are shown in Figure 1.

Figure 1: *Model One: factors that affect CIS integration*



It is not possible to discuss each feature due to space limitations, but note that the features identified are not necessarily independent of each other. This can be clearly seen by the fact that the CIS introduced in two of the hospitals were relevant to a doctor's job as they were methods of information storage and retrieval. However, doctors did not use them because they considered them too slow and wanted them to be mobile, which they were not; hence speed and system flexibility in terms of mobility, were linked factors. The model does not describe these interactions since the interactions varied between the sites. It was recognised that these features can be classified into two categories – 'Organisational Culture' and 'Actual Usefulness'. These categories enabled the development of model one (see Figure 1), which

[§] This is owing to the fact that the questionnaire was in English, although this was not considered a problem in the pilot.

shows that these two categories directly influence, and are influenced by, CIS integration.

Organisational Culture

The definition of organisational culture in the Introduction informed the categorisation of the factors in this category. One major factor for integration was Group Attitude. For example, those nurses who wanted to use the system were discouraged, as they had to correct colleague's inputs and input data for doctors who would not use the system. Again, users felt that training in the use of the system was essential, yet users at all three sites agreed that training 'on the job', especially in intensive care, is not practical and hinders care of the patient.

An imbalance between user and management expectations of the system strongly affects system integration. This was seen at site B, where hospital management introduced the system so that they could make better use of data collected; the users saw themselves as a tool for inputting the data that would then be used by management. Nurses and doctors could not see the benefit as it only replaced a single paper chart, and increased the size of the paper patient records two-fold due to print outs, significantly increasing the time taken to gain an overview of patient status. It could be argued that experience may reduce these problems, but from a users' perspective the previous system should not have been changed. The importance of using user knowledge and experience, for example, in system procurement can be seen from this quotation: "This is not the most appropriate system for us. I have worked in other hospitals and know of other systems that are much better". The importance of user involvement in system procurement was overlooked – only a few key personnel were involved in implementing the system. A simple survey of all users' requirements (and prior knowledge) may have better informed procurement decisions.

Actual Usefulness

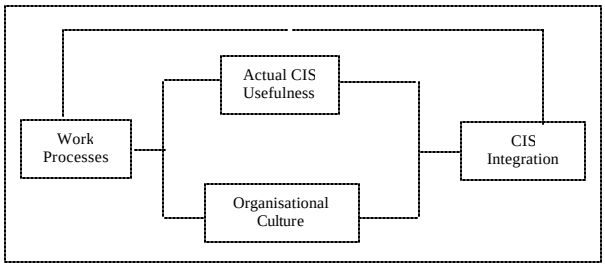
The second category in the model is 'Actual Usefulness'. This differs from 'Perceived Usefulness', one of the features used in TAM. While Perceived Usefulness is a valid concept, it is very abstract and difficult to measure and convey. Actual Usefulness, on the other hand, is directly observable and simpler to extract from and convey meaning to users.

Actual Usefulness is not the primary concern of this paper, which focuses on the importance of organisational culture for system integration. Therefore, discussion about this category is minimal. It was found that factors for Actual Usefulness are functions of both the user and the system. For example, the *speed* of using a system is dependent upon *user* knowledge of the system and typing skills as well as *system* functionality. *Quality* of a system is dependent upon the quality of user input and the functional quality of the system to be able to cope with the data.

The features within this category are very broad, i.e., there may be many levels of quality depending upon context. Each of the factors also inform each other, as well as information input and output, the system, the user and the organisational culture. This model identifies factors that contribute to CIS integration and categorises them as 'Organisational Culture' or 'Actual Usefulness'. However, CIS integration is an iterative process and directly affects ICU work processes, with the amount of change being dependent on the system and the extent to which it is integrated. To illustrate this, Model Two, shown in Figure 2, was developed from Model One.

Model Two

Figure 2: *The Iterative Systems Integration Model*

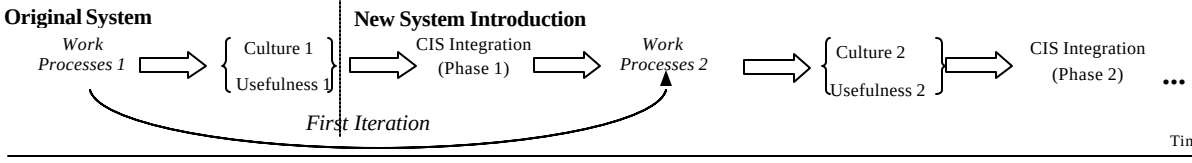


The change in work processes affects the organisational culture ('organisational culture is the way things are done around here'); the usefulness of the system is also affected through the features identified in Model One.

In turn, organisational culture and actual system usefulness again affect CIS integration.

The cycle iterates until it stabilises when the CIS is fully integrated or the CIS is rejected. The number of iterations for full integration will depend upon the amount of change required in the organisation's

Figure 3: *The first two cycles of ISIM*



culture, the usefulness of the system and the impact of the CIS on work processes; Figure 3 was constructed to illustrate this. Note that Actual Usefulness and Organisational Culture appear independent of each other in the model. However, they are not, as both affect CIS integration and therefore work processes, over a number of iterations.

Summary and Conclusions

This paper has shown that organisational culture is an important factor for systems integration in health care settings, here, intensive care. Data were collected from three hospitals with different CIS and used to extract features important for CIS integration. It was found that these features could be categorised as Actual Usefulness or Organisational Culture; Model One illustrated that these categories influence CIS integration. This model was then further developed into the Iterative Systems Integration Model (ISIM) to show the relationship between the defined categories, CIS integration, and work processes. ISIM goes further to show that these features form a cycle that can iterate several times while a system becomes integrated; the number of iterations will depend upon the organisational culture, the actual usefulness of the system and the work processes. The question of whether or not ISIM can be applied to other hospitals, other areas of health care, or even other sectors, still remains to be tested. The impact of organisational culture has previously been under-developed in health care, yet this paper shows that it has a significant role.

Future Work

This research forms part of a much larger study focussing on four sites. The study will examine all facets of organisational change: structure, culture, learning, managerial behaviour, and power and politics. The aim of this work is to develop a tool based on the ISIM that will consider the element of choice. The tool will measure the appropriateness of a system before it is procured, so that questions about whether or not a system is necessary may be rigorously answered.

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